

FINAL

Work Plan

Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

Prepared for
United States Army District, Jacksonville
United States Army Engineering and Support Center, Huntsville



Contract Number: W912DY-05-D-0007

Task Order Number: 0001

Project Number: I02PR006802



Prepared by
Ellis Environmental Group, LC
414 SW 140 Terrace, Newberry, FL 32669 • (352) 332-3888

January 2006

Last revised Sept. 21, 2006

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A handwritten signature in blue ink, reading "Mark H. Scott".

John D. Scott, PE, EEG Quality Control Manager

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at the

Municipality of Culebra, PR

US Army District, Jacksonville
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007, TO #0001

Independent Technical Review
Certification

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Contents

Abbreviations & Acronyms	xi
1.0 Introduction.....	1-1
1.1 General Information	1-1
1.2 Site Location	1-2
1.3 Site History.....	1-3
1.4 Topography	1-4
1.5 Climate	1-5
1.6 Geology.....	1-5
1.7 Hydrogeology	1-6
2.0 Technical Management Plan	2-1
2.1 Guidance, Regulations, and Policy	2-1
2.2 Recovered Chemical Warfare Materiel.....	2-3
2.3 Munitions and Explosives of Concern and Off-Site Disposal	2-3
2.3.1 Transportation of MEC	2-4
2.3.2 Temporary Storage of MEC	2-4
2.3.3 Off-Site Disposal Alternatives.....	2-4
2.3.4 Unidentifiable MEC.....	2-4
2.4 Technical Scope of the Project	2-5
2.4.1 Site Preparation.....	2-5
2.4.1.1 Grid Layout.....	2-5
2.4.1.2 Lane Width	2-5
2.4.2 Tools and Techniques	2-5
2.4.2.1 Vegetation Clearance.....	2-5
2.4.2.2 Description of the Ordnance Locators to be Used.....	2-6
2.4.2.3 Location Survey.....	2-6
2.5 Procedures for Changed Site Conditions	2-7
2.6 Project Organization.....	2-7
2.6.1 US Army Corps of Engineers, Jacksonville District.....	2-8
2.6.2 US Army Engineering and Support Center, Huntsville	2-8
2.6.3 Ellis Environmental Group, LC	2-8
2.6.3.1 Program Manager.....	2-8
2.6.3.2 Project Manager	2-8
2.6.3.3 UXO Quality Control / Safety Officer	2-9
2.6.3.4 Senior UXO Supervisor	2-9
2.6.3.5 Staff Engineers and Scientists.....	2-9
2.6.3.6 UXO Team Personnel	2-9
2.6.3.7 Site Manager	2-10
2.6.3.8 Site Administrator	2-10
2.7 Project Mobilization.....	2-11
2.7.1 Premobilization Activities.....	2-11
2.7.2 Field Office	2-13
2.8 Location Surveys and Mapping.....	2-13

2.9	Site Preparation	2-13
2.9.1	Tree Removal.....	2-14
2.9.2	Brush Clearing.....	2-14
2.9.3	Geophysical Equipment Testing.....	2-15
2.9.4	Surface Sweeps	2-15
2.10	Procedures for Reporting and Disposition of Munitions and Explosives of Concern.....	2-15
2.10.1	Personnel Responsibilities	2-15
2.10.2	Safety Precautions	2-16
2.10.3	Identification of MEC	2-18
2.10.4	Transportation of Explosives	2-18
2.10.5	Safe Holding Areas	2-19
2.10.6	Operations in Populated or Sensitive Areas.....	2-19
2.11	Demolition and Post-Demolition Operations	2-21
2.11.1	Responsibilities	2-21
2.11.1.1	Senior UXO Supervisor	2-21
2.11.1.2	Demolition Supervisor	2-21
2.11.1.3	UXO Quality Control / Safety Officer	2-21
2.11.2	Fire Prevention for Disposal Operations	2-22
2.11.3	General Requirements	2-23
2.11.4	Environmental Considerations	2-25
2.11.4.1	Extent of Impacts from Individual Shots	2-25
2.11.4.2	Extent of Impacts for Consolidated Shots	2-26
2.11.4.3	Minimization of Impacts.....	2-27
2.11.5	Non-Electrical Demolition Procedures.....	2-28
2.11.5.1	Safety Precautions	2-28
2.11.5.2	Preparation Procedures.....	2-28
2.11.5.3	Demolition Set-Up Procedures.....	2-29
2.11.6	Electrical Demolition.....	2-30
2.11.6.1	Electromagnetic Radiation.....	2-30
2.11.6.2	Blasting Caps and Safe Distances from EMR Source.....	2-30
2.11.6.3	Lightning, Electric Power Lines, and Static Electricity.....	2-31
2.11.7	Electrical Detonation Procedures	2-32
2.11.7.1	Safety Precautions	2-32
2.11.7.2	Procedures	2-34
2.11.8	Electrical Testing and Detonation Procedures for Rothenbuhler Remote Firing Device	2-35
2.11.8.1	Testing the Remote Firing Device	2-35
2.11.8.2	Setting Up the Remote Firing Device	2-36
2.11.8.3	Firing the Remote Firing Device	2-37
2.11.9	Procedures for Detonating Cord Use	2-38
2.11.10	Procedures for Time / Safety Fuse Use	2-39
2.11.11	Procedures for Perforator Use	2-40
2.11.12	Procedures for Binary Explosives Use	2-41
2.11.13	Meteorological Conditions	2-41
2.12	Pre-Demolition and Disposal Operations.....	2-42
2.12.1	Operational Briefing.....	2-42

2.12.2	Safety Briefing	2-43
2.12.3	Task Assignments	2-43
2.12.4	Preparing Explosive Charge for Initiation	2-44
2.13	Post-Demolition and Disposal Procedures	2-44
2.14	Misfire Procedures	2-45
2.14.1	Electrical Misfires	2-45
2.14.2	Electrical Misfire Procedures for Remote Firing Device	2-46
2.14.3	Non-Electrical Misfires.....	2-46
2.14.4	Detonating Cord Misfire.....	2-47
2.14.5	Perforator Misfire.....	2-47
2.15	Recordkeeping Requirement	2-48
2.16	Engineering Controls	2-48
2.17	Procedures for Material Potentially Presenting an Explosive Hazard	2-49
2.18	Munitions Debris and Range Residue Inspection, Certification, and Final Disposition.....	2-49
2.18.1	Responsibilities and Procedures	2-50
2.18.1.1	UXO Technician I	2-50
2.18.1.2	UXO Technician II	2-50
2.18.1.3	UXO Technician III	2-50
2.18.1.4	UXO Quality Control / Safety Officer	2-50
2.18.1.5	Senior UXO Supervisor	2-51
2.18.2	Munitions Debris Certification and Verification.....	2-52
2.18.3	Maintaining Chain of Custody and Final Disposition	2-53
2.19	Lessons Learned.....	2-53
3.0	Explosives Management Plan	3-1
3.1	General	3-1
3.2	Licenses and Permits.....	3-1
3.3	Acquisition.....	3-2
3.3.1	Description and Estimated Quantity of Explosives	3-2
3.3.2	Acquisition Source.....	3-3
3.4	Initial Receipt.....	3-3
3.4.1	Procedures for Receipt of Explosives.....	3-3
3.4.2	Reconciling Discrepancies	3-4
3.5	Storage.....	3-4
3.5.1	Safety Precautions	3-5
3.5.2	Key Control.....	3-5
3.6	Transportation	3-5
3.6.1	Transport from Storage Facility	3-5
3.6.2	Vehicle Requirements	3-6
3.6.3	Vessel Requirements	3-7
3.6.4	Unplanned Explosions at Sea	3-8
3.7	Receipt Documentation.....	3-8
3.7.1	Accountability	3-8
3.7.2	Authorized Personnel	3-8
3.8	Inventory	3-9

3.8.1	Physical Inventory Procedures	3-9
3.8.2	Reconciliation of Discrepancies	3-9
3.9	Lost, Stolen, or Unauthorized Use of Explosives.....	3-10
3.10	Procedures for Return to Storage	3-10
3.11	Procedures for Disposing of Remaining Explosives	3-10
3.12	Economic Analysis of Alternatives	3-11
4.0	Explosives Siting Plan	4-1
4.1	Safety Criteria	4-1
4.2	Distances and Areas.....	4-1
4.2.1	Munitions Response Sites	4-1
4.2.2	Planned or Established Demolition Areas	4-2
4.3	Footprint Areas.....	4-2
4.3.1	Blow in Place	4-2
4.3.2	Collection Points.....	4-3
4.3.3	In-Grid Consolidated Shots	4-3
4.4	Explosives Storage Magazines.....	4-3
4.4.1	Type of Magazines	4-3
4.4.2	Tabulated List of Explosives.....	4-4
4.4.3	Engineering Controls When Quantity-Distance Cannot Be Met.....	4-4
4.4.4	Site Maps	4-4
5.0	Geophysical Prove-Out Plan and Report	5-1
6.0	Geophysical Investigation Plan	6-1
6.1	Unexploded Ordnance Safety	6-1
6.2	Personnel Responsibilities and Qualifications	6-1
6.3	Geophysical Investigation Plan Outline	6-2
6.3.1	Site Description	6-2
6.3.1.1	Geophysical Data Quality Objectives	6-2
6.3.1.2	Areas To Be Investigated	6-3
6.3.1.3	Past, Current, and Future Use.....	6-3
6.3.1.4	Anticipated MEC Type, Composition, and Quantity	6-4
6.3.1.5	Anticipated Depth	6-5
6.3.1.6	Digital Topographic Maps.....	6-5
6.3.1.7	Vegetation	6-5
6.3.1.8	Geologic Conditions	6-5
6.3.1.9	Soil Conditions.....	6-6
6.3.1.10	Shallow Groundwater Conditions	6-6
6.3.1.11	Geophysical Conditions.....	6-6
6.3.1.12	Site Utilities.....	6-6
6.3.1.13	Manmade Features Potentially Affecting Geophysical Investigations	6-6
6.3.1.14	Site-Specific Dynamics.....	6-7
6.3.1.15	Site Accessibility and Impediments	6-7
6.3.1.16	Potential Worker Hazards.....	6-7
6.3.2	Geophysical Investigation	6-7
6.3.2.1	Survey Type	6-7

6.3.2.2	Equipment	6-7
6.3.2.3	Procedures	6-8
6.3.2.4	Personnel	6-9
6.3.2.5	Production Rates	6-9
6.3.2.6	Data Spatial Density	6-9
6.3.3	Instrument Standardization	6-9
6.3.4	Data Processing, Corrections, and Analysis	6-9
6.3.4.1	Initial Field Processing	6-10
6.3.4.2	Standard Data Analysis	6-10
6.3.4.3	Advanced Data Processing (if applicable)	6-10
6.3.4.4	Anomaly Selection and Decision Criteria	6-10
6.3.5	Dig Sheet Development	6-10
6.3.6	Anomaly Reacquisition	6-10
6.3.7	Feedback Process	6-10
6.3.8	Quality Control	6-10
6.3.9	Corrective Measures	6-11
6.3.10	Records Management	6-11
6.3.11	Interim Reporting	6-12
6.3.12	Map Format	6-12
6.4	Geophysical Investigation Performance Goals	6-12
6.4.1	Detection of MEC or Other Munitions	6-12
6.4.2	Horizontal Accuracy	6-12
6.4.3	False Positives	6-13
6.5	Geophysical Mapping Data	6-13
6.5.1	Monuments of Survey Markers	6-13
6.5.2	Geophysical Data Analysis, Field Reacquisition, and Reporting	6-13
6.5.3	Anomaly Reacquisition and Marking	6-13
6.5.4	Anomaly Excavation Reporting	6-13
7.0	Geospatial Information and Electronic Submittals	7-1
7.1	General	7-1
7.1.1	Accuracy	7-1
7.1.2	Geographic Information System Incorporation	7-2
7.1.3	Plotting	7-2
7.1.4	Mapping	7-2
7.2	Digital Design Data	7-3
7.3	Computer Files and Digital Data Sets	7-3
8.0	Work, Data, and Cost Management Plan	8-1
8.1	Project Management Approach	8-1
8.1.1	Project Management	8-1
8.1.2	Program Management	8-1
8.1.3	Site Management	8-1
8.1.4	Overall Approach	8-2
8.1.4.1	Work Plan	8-2
8.1.4.2	Community Relations	8-2

8.1.4.3	MEC Removal Action	8-2
8.1.4.4	Quality Control.....	8-2
8.1.4.5	Environmental Sampling.....	8-2
8.1.4.6	Final Removal Report.....	8-3
8.1.5	Controls to Ensure Timely Work Under Established Parameters.....	8-3
8.1.6	Subcontractor Management and Integration Procedures.....	8-3
8.2	Project Schedule	8-3
8.2.1	Milestones for Task Deliverables	8-4
8.3	Cost Control and Tracking Methodology	8-7
8.3.1	Costing	8-7
8.3.2	Billing.....	8-7
9.0	Property Management Plan	9-1
9.1	Responsibilities for Government Property	9-1
9.1.1	Project Manager	9-1
9.1.2	Site Manager	9-1
9.1.3	Property System Manager.....	9-2
9.1.4	Equipment Users.....	9-2
9.2	Description and Quantity of Materials To Be Used.....	9-2
9.2.1	Field Equipment	9-2
9.2.2	Office Equipment.....	9-3
9.2.3	Consumable Supplies	9-4
9.3	Sources and Estimated Rental and Acquisition Costs.....	9-5
9.3.1	Rentals	9-5
9.3.2	Purchases	9-6
9.4	Process to Acquire Quotes	9-6
9.5	Source for Leased Vehicles	9-6
9.6	Consumable Supplies and Personal Property Included in Overhead Rate.....	9-6
9.6.1	Reimbursable Expenditures	9-6
9.6.2	Unallowable Expenses	9-7
9.7	Proposed Storage Plan.....	9-8
9.8	Disposal Plan	9-8
9.8.1	Salvage	9-8
9.8.2	Turnover to Government	9-8
9.8.3	Other Disposition.....	9-8
9.8.4	Government-Furnished Property Tracking Reporting and Closure	9-9
9.9	Notification of Loss, Damage, or Destruction of Accountable Government Property.....	9-11
10.0	Quality Control Plan	10-1
10.1	Introduction	10-1
10.1.1	Policy Statement	10-1
10.1.2	Scope	10-1
10.1.3	Quality Assurance	10-1
10.2	Site-Specific Quality Control Plan	10-1
10.3	Quality Control Organization.....	10-2

10.3.1	Responsibilities and Authority	10-3
10.3.1.1	Program Manager.....	10-3
10.3.1.2	Quality Control Manager.....	10-3
10.3.1.3	Health and Safety Director	10-4
10.3.1.4	Project Manager.....	10-4
10.3.1.5	Independent Technical Reviewer	10-5
10.3.1.6	Project Chemist.....	10-5
10.3.1.7	Site Manager.....	10-5
10.3.1.8	UXO Quality Control / Safety Officer	10-6
10.3.1.9	GIS / Database Manager.....	10-7
10.3.1.10	Senior UXO Supervisor.....	10-7
10.3.1.11	Field Team Leaders.....	10-7
10.3.2	Qualifications and Training.....	10-8
10.4	Quality Management System.....	10-9
10.4.1	Deliverables.....	10-9
10.4.2	Field Activities	10-9
10.4.2.1	Pre-Mobilization Quality Control Process.....	10-14
10.4.2.2	Initial and Interim Field Inspections	10-14
10.4.2.3	Final Inspection	10-15
10.4.3	Documentation	10-15
10.4.4	Surveillance and Monitoring	10-16
10.5	Equipment Maintenance and Response Checks.....	10-17
10.5.1	Electromagnetic Detectors	10-17
10.5.2	GPS Units.....	10-17
10.5.3	Radios and Cellular Telephones	10-18
10.5.4	Vehicles and Associated Equipment	10-18
10.5.5	Hand Tools and Site-Specific Items	10-19
10.6	Records Management.....	10-19
10.7	Field Changes	10-20
10.7.1	Responsibilities	10-20
10.7.2	Procedures	10-20
10.7.3	Records	10-21
10.8	Comprehensive Site Audits.....	10-21
10.8.1	Responsibilities	10-22
10.8.2	Comprehensive Site Audit Report and Follow-Up.....	10-22
10.9	Non-Conformance and Corrective Action	10-23
10.9.1	Responsibilities	10-24
10.9.2	Procedure.....	10-24
10.9.2.1	Identification and Reporting of Non-Conformance	10-24
10.9.2.2	Evaluation of Non-Conformance Report.....	10-25
10.9.2.3	Recommendation of Corrective Action or Disposition	10-25
10.9.2.4	Corrective Action Implementation and Verification of Implementation	10-26
10.9.2.5	Client Notification and Approval History	10-26
10.9.2.6	Work Stoppage.....	10-26
10.9.2.7	Tracking of Non-Conformance Reports.....	10-26
10.10	Lessons Learned.....	10-27

10.10.1	Weekly Quality Management Debriefings	10-27
10.11	Chemical Data Quality Management Plan	10-27
11.0	Environmental Protection Plan	11-1
11.1	Resources	11-2
11.1.1	Endangered and Threatened Species	11-3
11.1.1.1	Benthic Habitats	11-4
11.1.1.2	Birds and Reptiles	11-6
11.1.2	Water Resources	11-9
11.1.3	Wetlands	11-9
11.1.4	Cultural and Archaeological Resources	11-10
11.1.5	Coastal Zones	11-10
11.1.6	Tree and Shrub Removal	11-13
11.1.7	Waste Disposal Sites	11-13
11.2	Mitigation Procedures	11-14
11.2.1	Manifesting, Transporting, and Disposing of Wastes	11-14
11.2.2	Burning Activities	11-14
11.2.3	Dust and Emissions Control	11-14
11.2.4	Spill Control and Prevention	11-14
11.2.5	Storage Areas and Temporary Facilities	11-15
11.2.6	Access Routes	11-15
11.2.7	Trees and Shrubs Protection and Restoration	11-16
11.2.8	Control of Water Run-on and Run-off	11-16
11.2.9	Equipment Decontamination and Disposal	11-16
11.2.10	Minimization of Disturbed Areas	11-16
11.2.11	Procedures for Post-Activity Cleanup	11-16
11.2.12	Air Monitoring Plan	11-16
11.2.13	Compensatory Measures	11-17
12.0	Investigation-Derived Waste Plan	12-1
12.1	On-Site Handling	12-1
12.1.1	Non-Hazardous Waste	12-1
12.1.2	Hazardous Waste	12-1
12.2	Storage, Transportation, and Treatment	12-1
12.2.1	Non-Hazardous Waste	12-1
12.2.2	Hazardous Waste	12-2
12.3	Disposal	12-2
12.3.1	Non-Hazardous Waste	12-2
12.3.2	Hazardous Waste Manifests	12-2
13.0	Interim Holding Facility Siting Plan for RCWM Projects	13-1
14.0	Physical Security Plan for RCWM Project Sites	14-1
15.0	References	15-1

Tables

Table 2-1.	Expected Munitions and Associated Removal Areas	2-3
Table 2-2.	Minimum Safe Distances Between Mobile Radio Frequency Transmitters and Electric Blasting Operations	2-31
Table 3-1.	Initial Demolition Explosives	3-3
Table 3-2.	Additional Explosives Supply Requirements for the Cays	3-3
Table 4-1.	Minimum Separation Distances	4-2
Table 6-1.	Geophysical Data Quality Objectives	6-2
Table 8-1.	Recurring Deliverables	8-8
Table 9-1.	Field Equipment	9-2
Table 9-2.	Office Equipment	9-4
Table 9-3.	Consumable Supplies	9-4
Table 10-1.	Quality Control Checks, Parameters, and Corrective Actions	10-9
Table 11-1.	Applicable or Relevant and Appropriate Requirements	11-1
Table 11-2.	To Be Considered Guidance	11-2
Table 11-3.	Threatened and Endangered Species Potentially Occurring in Culebra Island Archipelago	11-3
Table 11-4.	Nesting Marine Birds of the Culebra Archipelago	11-6

Figures

Figure 2-1.	Project Organization Chart	2-7
Figure 3-1.	ATF License	3-2
Figure 8-1.	Project Schedule	8-5
Figure 10-1.	Quality Control Organization Chart	10-2

Appendices

Appendix A.	Task Order Scope of Work
Appendix B.	Site Maps
Appendix C.	Local Points of Contact
Appendix D.	Accident Prevention Plan
Appendix E.	Munitions Constituents Sampling and Analysis Plan
Appendix F.	Contractor Forms
Appendix G.	MSD Calculation Sheets
Appendix H.	Resumés
Appendix I.	Conceptual Site Model
Appendix J.	Protected Species and Habitat Protocols

Abbreviations & Acronyms

°F	degrees Fahrenheit
AR	Army Regulation
ARAR	applicable or relevant and appropriate requirement
ASR	Archives Search Report
ATF	(Bureau of) Alcohol, Tobacco, and Firearms
ATFP	Alcohol, Tobacco, and Firearms Publication
BEM	buried explosion module
CADD	computer-aided design and drafting
CAIRA	Chemical Accident or Incident Response and Assistance
CAP	contractor-acquired property
CEHNC	United States Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	United States Army Corps of Engineers, Jacksonville District
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CWM	chemical warfare materiel
DA PAM	Department of the Army Pamphlet
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DID	Data Item Description
DNER	Department of Natural and Environmental Resources
DoD	Department of Defense
EE/CA	Engineering Evaluation / Cost Analysis
EEG	Ellis Environmental Group, LC
EM	Engineer Manual
EMR	electromagnetic radiation
EOD	explosive ordnance disposal
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
ER	Engineer Regulation
ESA	Endangered Species Act
ESE	Environmental Science and Engineering, Inc.
FAR	Federal Acquisition Regulation
FGDC	Federal Geographic Data Committee
FUDS	Formerly Used Defense Sites
FWS	Fish and Wildlife Service
GFP	government-furnished property

GIS	geographic information system
GPS	global positioning system
HAZWOPER	hazardous waste operations and emergency response
HD	Hazard Division
HQDA	Headquarters Department of the Army
HTRW	hazardous, toxic, and radioactive waste
ID	identification
IDW	investigation-derived waste
IME	Institute of Makers of Explosives
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
MGFD	munitions with the greatest fragmentation distance
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MSD	minimum separation distance
NAVD88	North American Vertical Datum of 1988
NEW	net explosive weight
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
OB/OD	open burning / open detonation
OE	ordnance and explosives
OOU	ordnance operating unit
OSHA	Occupational Safety and Health Administration
PDF	Portable Document Format
PETN	pentaerythritol tetranitrate
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QCP	Quality Control Plan
Q-D	quantity-distance
RCWM	recovered chemical warfare materiel
SDSFIE	Spatial Data Standards for Facilities Infrastructure and Environment
SDTS	Spatial Data Transfer Standard
SOW	scope of work
SUXOS	senior unexploded ordnance supervisor
TB	Technical Bulletin

TM	Technical Manual
TP	Technical Paper
TPP	Technical Project Planning
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQC/SO	unexploded ordnance quality control / safety officer

1.0 Introduction

1.1 General Information

1.1.01 Ellis Environmental Group, LC (EEG), under contract to the United States Army Engineering and Support Center, Huntsville (CEHNC), is providing non-time-critical removal operations on Culebra Island and adjacent islands, or cays, in Puerto Rico. This area was used during the period 1903 through 1975 by the Department of Defense (DoD) for numerous military maneuvers and range training.

1.1.02 The Findings and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS); however, upon subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS.

1.1.03 The United States Army Corps of Engineers (USACE), Rock Island District, compiled an Archives Search Report (ASR) dated February 1995. The ASR determined the types, quantities, and probable locations of munitions and explosives of concern (MEC) remaining at the Culebra Island National Wildlife Refuge. The ASR identified 32 suspected ordnance areas. Ordnance was verified at 11 sites. These sites included the Northwest Peninsula and Flamenco Beach¹ (bombing and naval bombardment range), Cerro Balcon (mortar range), Isla Culebrita (strafing range and torpedo range), and Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza (all aerial bombardment sites).

¹ Work at Northwest Peninsula and Flamenco Beach is specifically excluded from any action under the present work plan. USACE's participation in the reasonable cleanup of Culebra and surrounding cays is subject to the obligations and restrictions set forth in Section 204(c) of the MILCON Act of 1974, Public Law 93-166. This Act prohibits the use of federal funds to decontaminate the area referenced in Section 204(c). As a result, the "present bombardment area" on the island of Culebra shall not be utilized for any purpose that would require decontamination at the expense of the United States. In addition, Section 9 of the quitclaim deed from the United States to the Commonwealth states: "In accordance with the provisions of Section 204 of Public Law 93-166, that portion of the subject property which has heretofore been used as a bombardment area by the United States Navy is hereby accepted by Grantee in its present condition and further agrees that the United States shall not in any manner be responsible for decontamination of such area, nor for the costs thereof, but the same is and shall be solely (sic) the responsibility of the Grantee." Detailed analysis of all currently available information indicates that this "present bombardment area" is limited to an area on the northwest peninsula of Culebra. As stated in the Preliminary Points of Agreement (PPA) (Appendix A of this Work Plan), the Commonwealth does not necessarily agree with the interpretation, application of Section 204, and/or legal significance of this legal provision; however, USACE and the Commonwealth have willingly entered into the PPA without renouncing or disclaiming any legal or factual claims they may have and may invoke them at a later time. Despite the legal differences, USACE and the Commonwealth desire to investigate and take appropriate response actions to respond to threats to public health and the environment from past military activities in Culebra.

1.1.04 Environmental Science and Engineering, Inc. (ESE) conducted an Engineering Evaluation / Cost Analysis (EE/CA) investigation of these sites in October 1995. The EE/CA investigation was performed in accordance with DERP-FUDS; the National Oil and Hazardous Substances Pollution Contingency Plan, commonly called the National Contingency Plan; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly called Superfund; and relevant United States Army regulations and guidance for ordnance and explosive waste programs. In the EE/CA Report (ESE 1996), ESE characterized the type of ordnance found and assessed the exposure potential at each of the sites based on the statistical sampling of randomly placed grids at each of the 11 sites. ESE then evaluated several remedial action alternatives based on the nine CERCLA evaluation criteria.

1.1.05 ESE identified five separate ordnance operable units (OOU) based on location, previous land usage, and similar geographical characteristics. The selected remedial alternatives included clearance for use at Flamenco Beach (OOU-1) and the Northwest Peninsula (OOU-2), and surface clearance of MEC and munitions constituents (MC) at Cerro Balcon (OOU-3), Isla Culebrita (OOU-4), and the adjacent cays (OOU-5), including Cayo Botela, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. An EE/CA Action Memorandum (ESE 1997) was filed which identified clean-up options and was approved by DoD.

1.1.06 This Non-Time-Critical Removal Action Plan is created to implement the surface removal actions presently approved at Cerro Balcon, Isla Culebrita, Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza.

1.1.07 Recently, USACE St. Louis District was enlisted by the USACE Jacksonville District (CESAJ) to conduct further archive searches to supplement the data from the initial ASR. The supplemental ASR adds to the findings of the original ASR prepared by USACE in February 1995 (USACE 2004) and identified additional areas of potential concern for Culebra and the adjacent cays. The data from these findings will be the basis of future investigations and removal actions.

1.2 Site Location

1.2.01 Adjacent to Culebra Island are about 24 cays, mostly owned by the United States Fish and Wildlife Service (FWS). The total land area is approximately 7,300 acres, of which approximately 1,500 acres are owned by FWS. The Commonwealth of Puerto Rico owns the

remainder, of which approximately 1,200 acres are primarily in the custody of the Puerto Rico Department of Natural and Environmental Resources (DNER) and approximately 4,600 acres are owned by private citizens and the Municipality of Culebra. DNER ownership extends from the high-tide mark to 9 nautical miles out.

1.2.02 Culebra Island is separated from Puerto Rico by about 17 miles of Vieques Sound. The Caribbean Sea lies to the south, and the Atlantic Ocean lies to the north. The warm, clear waters provide a home for a wide variety of sea life that attracts scuba divers from all over the world.

1.2.03 Surface clearance of MEC will be conducted over 30 acres on the western flank of Cerro Balcon, 82 acres of the northwest end of Isla Culebra, and up to 39.5 acres of additional cays, including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. Appendix B (Map B-1) provides the locations of these sites.

1.3 Site History

1.3.01 Ships with heavy armaments and carriers of the United States Navy and the North Atlantic Treaty Organization used the former Culebra Island naval facility on Culebra Island, Puerto Rico, for training. Facilities constructed by the Navy included a desalination plant, an airfield, barracks, helicopter pads, range instrumentation facilities, gun sites (for the defense of the islands), observation points, and impact ranges for aerial bombs and rockets, missiles, mortars, and naval ordnance.

1.3.02 Culebra Island and adjacent cays were used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The Marines used Culebra Island as a training facility from 1903 until 1941, during which time a rifle range was constructed at the airfield site. The United States Caribbean fleet used Culebra Island and the adjacent cays for naval exercises throughout its history. A large fleet exercise was conducted from December 1923 through February 1924. Approximately 3,300 Marines participated in the maneuvers armed with 155-millimeter (mm) guns, 75 mm guns, and machine guns. The exercise involved the 5th Marine Corps Regiment, which included a “gas platoon.” This is the only indication of the possible presence of chemical warfare materiel (CWM). Another fleet exercise was conducted from January through March 1935.

1.3.03 The Navy abandoned the lower camp area in 1920. This area was re-activated in 1942 before its reduction to caretaker status in 1944. Culebra Island was used as a bombing and

gunnery range from 1935 through 1975. Naval records indicate bombardment of Flamenco Peninsula in 1936 and again in 1949.

1.3.04 The Navy also conducted submarine warfare maneuvers. Fourteen live torpedoes were fired at Cayos Geniqui in November 1959, and records indicate that submarines also fired torpedoes at Marcs Point on Isla Culebrita. The firing of torpedoes within the area of Culebra and the adjacent cays ceased prior to 1969.

1.3.05 Until the early 1960s, Flamenco Peninsula, Los Gemelos, and Alcarraza were the only aircraft targets in the complex. To support increased training needs during Vietnam operations, the Navy acquired additional training areas on cays east and west of Culebra Island for use as aircraft ranges. Navy records indicate that Flamenco Peninsula was the target area for naval gunfire support training. Ships fired from ranges of 2,000 to 12,000 yards. In 1969, ships fired live 40 mm, 3-inch, 5-inch, 6-inch, and 8-inch rounds. It is likely that 81 mm illuminating rounds were also fired. Ships from Great Britain, Canada, Germany, Netherlands, France, Brazil, Columbia, and Venezuela also used Flamenco Peninsula target facilities.

1.3.06 In 1964, the target range was expanded to the eastern and western cays. Aerial mining operations were also conducted in these outlying areas. Live ordnance operations reached their peak in 1969, when the fleet was training pilots for Vietnam. Aircraft bombing and strafing of Flamenco Peninsula ended in 1970, and the use of live rounds for naval gunfire support training ended in 1971. Subsequent naval support training was conducted using quarter puff rounds until ordnance use was terminated on September 30, 1975.

1.4 Topography

1.4.01 Culebra Island is underlain by both intrusive and extrusive volcanic rock of the Upper Cretaceous Age. The volcanic rock exhibits little or no porosity due to compaction and filling of the pores with quartz and calcite. The volcanic rocks exhibit strong magnetic properties that can affect magnetometer readings.

1.4.02 Culebra Island (598 acres) has sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep hills, and narrow valleys. Ninety percent of the island is hilly, with population concentrations in the flatlands. The highest point on Culebra Island is Monte Resaca, which is approximately 630 feet above mean sea level. The island has a limited variety of soil types due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate.

Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate.

1.4.03 Fresh water is scarce on the island, and it is high in chloride and saline. Most residents get their water from a desalination plant installed by the Navy at the lower camp and from some shallow (10 to 20 feet deep) wells and a water line from the Island of Puerto Rico. Surface water is also scarce, and creeks and streams are intermittent and seasonal. Normally they are dry and collect and drain runoff water only during rainstorms. Approximately 12 natural springs and seeps exist, but they are charged only during particularly wet seasons.

1.4.04 The National Oceanic and Atmospheric Administration estimates that water depths average approximately 70 to 90 feet in the areas surrounding Culebra Island; however, some areas west of Flamenco Peninsula and east of Cayos Geniqui are more than 130 feet deep. Local maritime charts show “Caution unexploded ordnance (UXO)” in the northern and western areas. Tidal data for Culebra Island indicates that tides are chiefly diurnal. The height difference between mean higher high water and mean lower low water is 1.1 feet. The mean tide level is 0.6 foot.

1.5 Climate

Culebra Island has a tropical marine climate, with a year-round average daily temperature of 80 degrees Fahrenheit (°F). The average rainfall is 36 inches, and the average humidity is approximately 73 percent, with a daytime average of approximately 65 percent and a nighttime average of approximately 80 percent. The most humid months are August through January, although the humidity in the remaining months is only slightly lower. Prevailing winds are from the east-northeast for November through January and from the east for the rest of the year. Average wind speed is 8 knots. The hurricane season is from June through November, with most storms occurring July through September. Severe hurricanes occur through this area every 15 to 33 years.

1.6 Geology

1.6.01 Puerto Rico and its outlying islands are part of an island arc that largely consists of faulted and folded vulcaniclastic and sedimentary rock, which is locally intruded by igneous rock. These rocks range from Cretaceous to Eocene in age (USGS 1999).

1.6.02 Culebra and the adjacent cays are underlain by volcanic and intrusive rocks of Upper Cretaceous Age. Andesite lava and andesite tuff are clearly dominant. Toward the north-central part of Culebra and on eastern Cayo Luis Pena, the tuff and lava contain diorite porphyry inclusions. These volcanic rocks no longer exhibit porosity, due to compaction and the filling of pores with quartz and calcite (USACE-RI 1995).

1.6.03 The bedrock beneath most of Culebra is andesite lava and lava breccia. This material is generally overlain by a thin (generally 2 to 3 feet thick) layer of disturbed saprolite (USACE-RI 1995). In the area of the project sites, the ground surface has been impacted by the detonation of ordnance as part of DoD activities, which may have locally fractured some of the rock.

1.7 Hydrogeology

1.7.01 About a dozen natural springs and seeps exist on Culebra Island, but they are charged only after particularly wet seasons. Some wells 10 to 20 feet deep exist in areas away from coastal seepage, but these wells are high in chloride concentrations and salinity. As a result, most Culebra citizens get their fresh water from the desalinization plant installed by the Navy at the lower camp or from a potable-water pipeline that connects Culebra with the main island of Puerto Rico (USACE-RI 1995).

1.7.02 Due to the shallow bedrock and impermeability of the lava and overlying soil, the potential for use of groundwater as a potable domestic, municipal, or commercial water source is virtually nonexistent. No significant aquifers are on Culebra Island and the adjacent cays.